SEISMIC EXPLORATION FOR WATER ON MARS

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This proposal is intended to promote discussion under Topic III at the Symposium on Mars, Evolution of its Climate and Atmosphere. It is proposed to soft-land three seismometers in the Utopia-Elysium region and three or more radio-controlled explosive charges at nearby sites that can be accurately located by an orbiter. Seismic signatures of timed explosions, to be telemetered to the orbiter, will be used to detect present surface layers, including those saturated by volatiles such as water and/or ice.

The Viking Landers included seismometers, and the one on Viking 2 that did not fail showed that Mars is at present seismically quiet, and that the mean crustal thickness at 47°.96 N 225°.77 is about 14-18 km. (1) The new seismic landers must be designed to minimize wind-vibration noise, and the landing sites selected so that each is well founded on the regolith, not on rock outcrops or in craters. The expolsive charges might be mounted on penetrators aimed at nearby smooth areas. They must be equipped with radio emitters for accurate location and radio receivers for timed detonation.

Areas where subsurface water may be located on Mars were recently discussed at Lunar and Planetary Science XVII (2,3), and Utopia-Elysium is a prime contender, as noted earlier by Harold Masursky (4).

The Active Seismic Experiment worked well on Apollo 16, and the technique described by Kovach, Watkins, and Talwani (5) should apply equally well on Mars as on the Moon. They determined that the lunar regolith at the Apollo-16 landing site is 12.2 m thick.

Definite detection of water- or ice-bearing layers on Mars will be of value in tracing the history of Mars' climate and atmosphere, and in planning manned missions to the planet.

References: (1) D. L. Anderson in E. C. Ezell and L. N. Ezell, 1984, On Mars: Exploration of the Red Planet, 1958-1978, NASA SP 4212, p392

(2) B. K. Lucchitta, M. A. Ferguson, and C. Summers, 1986, Lunar and Planetary Science XVII Abstracts, p 4[illegible]-4[illegible]

(3) E. H. Christiansen and J. A. Hopler, 1986, LPS XVII Abstracts p 125-126

(4) H. Masursky in E. C. Ezell and L. N. Ezell, loc cit, p 342

(5) R. L. Kovach, J. S. Watkins, and P. Talwani, 1972, Apollo 16 Preliminary Science Report, NASA SP 315, p 10-1 to 10-14